REMARKS

In the Office Action, claims 1-25 were rejected. All pending claims are believed to be clearly allowable. Reconsideration and allowance of all pending claims are requested.

Rejections Under 35 U.S.C. § 103

Independent claims 1, 13 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Arz et al. (U.S. Patent 6,636,041, hereinafter "Arz") in view of Twerdochlib (U.S. Patent 4,827,487, hereinafter "Twerdochlib"). Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. Applicants respectfully assert that the present invention, as recited in independent claims 1, 13 and 17, is patentable over Arz and Twerdochlib.

Claim 1 and claims depending therefrom.

Independent claim 1 is clearly distinguishable from the teachings of Arz and Twerdochlib. In particular, neither Arz nor Twerdochlib teaches, discloses or suggests at least "passing a light through a non-magnetic optical fiber inserted in a *non-magnetic sheath* wound and cast with the electrical winding, the optical fiber having a core containing at least a first Bragg grating etched therein", as recited in claim 1.

Moreover, Arz, while recognizing the possibility of using Bragg gratings for temperature sensing, actually teaches away from such use where temperature signals are to be distinguished from other causes of deformation. Rather, Arz would teach those skilled in the art to use separate temperature sensors. The references thus also fail to support the combination/modification in view of the specific teachings of Arz.

<u>Neither Arz nor Twerdochlib teaches a non-magnetic sheath.</u>

Arz does not teach, disclose, suggest, or provide a motivation to employ a non-magnetic sheath to isolate deformations due to sensed temperature from other deformations. Indeed, Arz does not provide any mechanism for isolating external influences by using a non-magnetic optical fiber inserted in *a non-magnetic sheath* wound and cast with an electrical winding, where the optical fiber has a core with at least a first Bragg grating etched therein, as claimed.

Applicants disclose within the specification that the use of a *non-magnetic sheath* helps to isolate temperature-originating deformation of the optic fiber from any influence of external deformations other than that due to temperature. This is made clear, for example, from the following excerpt from paragraph 19:

> Because optical fiber 14 is free to slide inside sheath 40, it is essentially isolated from stresses that deform electromagnetic coil assembly 12, so that Bragg gratings 20 in optical fiber 14 are essentially unaffected by such stresses.

This is further illustrated in FIG. 1, in which sheath 40 is shown to be providing protective covering for the inner optic fiber and the Bragg grating assembly.

Similarly, Twerdochlib discloses measuring temperature along individual coils of a water-cooled stator winding in an electric generator, in which a hollow *electrically conductive* sheath-like structure is used over the sensors. In particular, as set forth in column 4 of Twerdochlib:

> In a preferred embodiment of the invention, there is provided one or more *hollow conductive members 28 in each coil section 14, each suitable for containing a distributed sensor probe 38* which may extend through the plurality of half turn coil sections 14 that form a coil winding. The necessary cross sectional area for placing a probe in the hollow cores of the members 28 is relatively small, e.g., 1.6×105 square inches, in comparison to the

> strand cross sectional area. One or more hollow strands 28 with the same outer dimension as a one of the solid strands 16 is integrated into each coil section 14 for use as a sheath for containing a sensor probe.
>
> Twerdochlib, col. 4, lines 18-29 (emphasis added).

Thus, Twerdochlib teaches a sheath that is electrically conductive. Nothing in the reference teaches that the sheath should be magnetically conductive.

Clearly, because neither reference teaches the use of a non-magnetic sheath as claimed, the combination necessarily lacks elements of claim 1.

<u>Arz specifically teaches away from temperature and deformation separation without a separate sensor.</u>

Even though Arz acknowledges in the prior art that optical fibers could be used for temperature sensing, Arz teaches that if temperature has to be separated from deformations, separate temperature sensors have to be used. In fact, using the optical fibers is what Arz teaches not to do. The only motivation to use a sheath for separating influences of deformation and temperature is provided by the claim 1.

The Office Action mentions that Arz discusses in the background that Bragg gratings could be used as a sensor for acquiring temperature data, since the Bragg gratings depend on temperature, which leads to a modification of grid spacings of the Bragg grating. Arz acknowledges that temperature sensors could be provided in the windings to monitor the temperature. In particular, Arz discloses in the col. 2,

> The above articles point out the possibility of utilizing the fiber Bragg grating in a measuring instrument as a sensor for acquiring temperature changes and/or changes in length. The suitability of a fiber Bragg grating for this purpose particularly derives from the dependency of the Bragg wavelength on the temperature and/or on a mechanical stretching or compression of the Bragg grating, which leads to a modification of the grid

spacings of the Bragg grating, and thus to a characteristic change of the wavelength of the light reflected by the Bragg grating.

Arz, col. 2, lines 32-41.

However, the problem addressed by the invention is to separate deformations due to temperature from other deformations. Arz does not teach any technique for separating such deformations.

Furthermore, Arz admits that even mechanical stretching or compression of the Bragg grating can cause a change in wavelength of the light passed through the Bragg grating. In fact, Arz actually acknowledges that *temperature cannot be sensed by the Bragg gratings alone* and that separate temperature sensors are required. The very purpose of *completely separate temperature sensors*, as specifically taught by Arz, is to isolate the deformation resulting from sensed temperature from the deformation due to oscillation.

In particular, as set forth in column 6 of Arz:

For optimal surface-coverage and comprehensive deformation acquisition of the gradient coil system 21, the optical fibers LF 10, LF 20 and LF 30, in particular, are arranged surface-proximate at an inside as well as at an outside hollow cylinder surface in one embodiment and exhibit a corresponding density of Bragg gratings BG 11 through BG 38. A correspondingly high-resolution acquisition of deformations of the gradient coil system 21 is thus possible. *In a supplementary embodiment, at least one temperature sensor is arranged within the gradient coil system 21 for acquiring an operating temperature of the gradient coil system 21, particularly of the optical fibers LF 10, LF 20, LF 30 and LF 40, and is connected to the operating device 51 for the communication of acquired operating temperatures. As a result, the operating device 51 is able to separate deformations produced due to variations of the operating temperature, for example as a result of a flow of current within the gradient and/or shielding coils, from deformations as a consequence of oscillations of the gradient coil system 21.*

Arz, col. 6, lines 11-30 (emphasis added).

Because Arz specifically teaches that temperature should *not* be sensed via Bragg gratings, but instead by separate sensors, the combination or modification suggested by the Examiner would contravene the very teachings of the reference. As such, the combination or modification is simply not supported.

Thus, in summary neither Arz nor Twerdochlib specifically teach, disclose, suggest, or show a motivation to provide a non-magnetic sheath to isolate the deformations due to sensed temperature from other deformations due to external influences. Similarly, the references do not support the combination or modification required for a *prima facie* case of obviousness. Thus, it is respectfully requested that the rejection of claim 1 under 35 U.S.C. §103(a) be withdrawn.

Claims 13 and 17:

Independent claims 13 and 17, like claim 1, recite the use of a non-magnetic sheath for isolating deformations due to sensed temperature from other deformations due to external influences. As noted above, neither Arz nor Twerdochlib provide a sheath for isolating the deformation resulting from sensed temperature from other deformations. In fact, Twerdochlib uses a conductive sheath. Moreover, Arz specifically teaches that temperature and deformation separation should be done using separate sensors.

Therefore, neither Arz nor Twerdochlib specifically teach, disclose, suggest, or show a motivation to separate deformations due to sensed temperature from other deformations due to external influences as claimed. Thus, the references do not support a *prima facie* case of obviousness of claims 13 and 17. It is respectfully requested that the rejection of claims 13 and 17 and their dependent claims under 35 U.S.C. §103(a) be withdrawn.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

Date: 8/16/2005

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